

WHAT IS CLAIMED IS:

1. A mixed conductor wherein an electron conductor made of an inorganic material is fixed to a proton conductor made of an inorganic material so as not to dissolve in water.
- 5 2. A mixed conductor wherein an electron conductor made of an inorganic material obtained by carbonizing an organic material is fixed to a proton conductor made of an inorganic material.
- 10 3. The mixed conductor according to claim 1, wherein said electron conductor is obtained by carbonizing at least one selected from a group consisting of aliphatic hydrocarbon, aromatic hydrocarbon and derivatives of the aliphatic hydrocarbon and the aromatic hydrocarbon.
- 15 4. The mixed conductor according to claim 2, wherein said electron conductor contains at least one selected from a group consisting of polyacetylene, resorcinol, phenol, phenylphenol, polyaniline, polypyrrole, polythiophene, phenylphosphonic acid, and phenylsilane alkoxide.
5. The mixed conductor according to claim 1, wherein said electron conductor is made of a carbonaceous material such as graphite or a carbon nanotube.
- 20 6. The mixed conductor according to claim 1, wherein said proton conductor contains at least one selected from a group consisting of a phosphorus-containing compound, a sulfur-containing compound, carboxylic acid, boric acid, and inorganic solid-state acid.
7. The mixed conductor according to claim 1, wherein the electron conductor is fixed to the proton conductor by a covalent bond.
- 25 8. The mixed conductor according to claim 1, wherein the electron conductor is fixed to the proton conductor by intercalation.
9. The mixed conductor according to claim 1, wherein the electron

conductor is fixed to the proton conductor by inclusion.

10. The mixed conductor according to claim 1, wherein said electron conductor has consecutive carbon-carbon bonds including a carbon-carbon double bond.

5 11. The mixed conductor according to claim 1, wherein said electron conductor is obtained by carbonizing an organic compound having one of or both of a carbon-carbon double bond and a carbon-carbon triple bond.

12. A method for producing a mixed conductor comprising:

10 a first step of obtaining a high molecular precursor by polymerizing an organic compound having one of or both of a carbon-carbon double bond and a carbon-carbon triple bond with a proton conducting material; and

a second step of burning the precursor obtained in the first step under an inert atmosphere.

13. A method for producing a mixed conductor comprising:

15 a first step of obtaining a high molecular precursor by dispersing a proton conducting material into an organic compound polymer having one of or both of a carbon-carbon double bond and a carbon-carbon triple bond; and

a second step of burning the precursor obtained in the first step under an inert atmosphere.

20 14. The mixed conductor producing method according to claim 12, wherein the organic compound having one of or both of the carbon-carbon double bond and the carbon-carbon triple bond is aliphatic hydrocarbon or aromatic hydrocarbon.

15. The mixed conductor producing method according to claim 14, 25 wherein said organic compound is at least one selected from a group consisting of polyacetylene, resorcinol, phenol, phenylphenol, polyaniline, polypyrrole, polythiophene, phenylphosphonic acid, and phenylsilane

alkoxide.

16. The mixed conductor producing method according to claim 12, wherein said proton conducting material is at least one selected from a group consisting of a phosphorus-containing compound, phosphoric acid, ester phosphate, sulfuric acid, ester sulfate, sulfuric acid, tungsten oxide hydroxide, rhenium oxide hydroxide, silicon oxide, tin oxide, zirconia oxide, tungstophosphoric acid, and tungstosilicic acid.

17. A mixed conductor producing method wherein an organic compound having a π bond is dehydration-condensation polymerized and bound with a compound having movable protons to obtain a precursor having proton conduction, and an energy is applied to said precursor under an inert gas atmosphere to thereby impart electron conduction to the precursor.

18. The mixed conductor according to claim 1, wherein said mixed conductor supports a noble metal catalyst.

19. The mixed conductor producing method according to claim 12, comprising a third step of causing the precursor burned in said second step to support a noble metal catalyst.